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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/814,697	03/30/2004	Xiaolei Shi	140264	7228

6147 7590 10/02/2008

GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
PATENT DOCKET RM. BLDG. K1-4A59
NISKAYUNA, NY 12309

EXAMINER	
VERDERAME, ANNA L	

ART UNIT	PAPER NUMBER
1795	

NOTIFICATION DATE	DELIVERY MODE
10/02/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/814,697	SHI ET AL.	
	Examiner	Art Unit	
	ANNA L. VERDERAME	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 June 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *13-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *13-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

The response filed on 06/12/2008 has been carefully considered. A response is presented below.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claim 13, 23 and 25 are rejected under 35 U.S.C. 102(e) as being anticipated by Hwang et al. 2004/0161575 as evidenced by Arnone et al.

WO/00/75641(6,828,558 used as a translation).

Hwang et al. claims a high-density optical disk comprising a substrate with pits (data layer and supporting substrate) and at least one mask layer with a super resolution near-field structure wherein at least one mask layer comprises a mixture of a dielectric material and metal particles. Claim two recites the suitable dielectric materials as being metal oxide, nitride, sulfide, fluoride, or mixture thereof. Applicant discloses that the metal particles may be gold particles. Figure 3 shows that the invention of this application results in improves C/N (dB) ratio when recording smaller marks as compared to the prior art. The mask layer, containing metal particles dispersed in a

dielectric material, acts as an aperture for near field light due to self-focusing effect. Therefore fine marks with a size of, for example, 100 nm or less can be read using a laser with a wavelength of, for example 680 nm. Metal particles have a size smaller that a wavelength of a laser beam (0029). Dielectric materials used in the masking layer 11 include any of SiO2, Al203, Si3N4, SiN, **ZnS**, and MgF2 (0030). Metal particles to be dispersed in the masking layer include **gold,** platinum, rhodium, and palladium (0030). The application also discusses the prior use of silver oxide super resolution films (0013). This is also discussed in the applicants Background section at (0007). An optical recording medium having a large capacity can be obtained without decreasing the wavelength of the laser diode (0014).

Since the claims are to the combination of a mask layer with a data layer, and not to a photosensitive data layer, the art anticipates the claims.
Hwang et al. does not explicitly state that the dielectric materials used in the masking layer are non-linear optical materials.

Claim 10, of Arnone et al. WO 00/75641(6,828,558 used as a translation),recites a material with non-linear optical properties chosen from a group including ZnS. The teachings of this reference are used solely to establish that the dielectric materials recited by Hwang et al. inherently exhibit non-linear optical properties.
The applicant's disclosure regarding acceptable materials for use as the non-linear optical material of the masking layer is extremely vague. Disclosure of

specific materials would help to make the specification clearer and would have helped in the examination of this application. However, addition of such specific materials would be considered new matter.

The applicant argues that ZnS does not exhibit non-linear optical properties at the intensities used in the Hwang reference. The applicant uses Krauss et al. as evidence for this claim. However, the examiner notes that Hwang uses powers within the range recited in claim 13 and also Krauss et al. does not disclose the non-linear behavior of ZnS in a composite film comprising ZnS having nano-particles embedded therein. Further, the examiner notes that claim 13 does not recite intensities for the gate beam and therefore embrace embodiments where the intensity of the gate beam can be outside of the range held by the applicant to be the range in which ZnS exhibits non-linear behavior.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 14-15,20, and 23-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. 2004/0161575 as evidenced by Amone et al.

WO/00/75641(6,828,558 used as a translation) in view of Nomura et al. JP2002-133720.

Nomura et al. teaches an optical recording medium as shown in figure one where on the light-transmitting polycarbonate substrate 2 there is formed, a first dielectric film 4 of ZnS-SiO2 having a thickness of 75 nm, a AgInSbTe phase change recording layer having a thickness of 20 nm, a second dielectric film 8 of ZnS-SiO2 having a thickness of 10 nm, a mask layer comprising a dielectric material (SiO2) 10A and metal particles (Ag) 10B, a reflective layer 10, and a protective layer 12(0012-0013). Nomura et al teaches a near field super resolution layer in a phase change optical recording medium. This layer is a dielectric layer, including SiO2, **ZnS**-SiO2, Al203, and SiN with metal particles, such as **Au, Ag**, or Al dispersed therein (0007). In super-resolution films of the prior art it was difficult to control the size of the metal particle. This problem is solved by the present invention(0005). This invention allows for recognizing the minute record mark below a diffraction limitation and reproducing information (0006).
Nomura et al. does not explicitly state that SiO2 ZnS-SiO2, Al_2O_3, and SiN are non-linear optical materials.

It would have been obvious to modify the medium taught by Hwang et al. by forming a spacer layer of ZnS-SiO_2 or SiN between the data layer and the mask layer based on the example of Nomura et al. and with the reasonable expectation of success. Further, it would have been obvious to form a mask layer comprising **ZnS-**SiO_2 and silver or gold metal particles dispersed therein based on the example of Nomura et al. and based on the disclosure in Hwang et al. to use SiO_2 or ZnS as the matrix material.

$ZnS\text{-}SiO_2$ would be expected to exhibit non-linear optical properties due to the fact that it contains ZnS which has been shown to be a non-linear optical material.

The applicant argues that ZnS does not exhibit non-linear optical properties at the intensities used in the Hwang reference. The applicant uses Krauss et al. as evidence for this claim. However, the examiner notes that Hwang uses powers within the range recited in claim 13 and also Krauss et al. does not disclose the non-linear behavior of ZnS in a composite film comprising ZnS having nano-particles embedded therein. Further, the examiner notes that claim 13 does not recite intensities for the gate beam and therefore embrace embodiments where the intensity of the gate beam can be outside of the range held by the applicant to be the range in which ZnS exhibits non-linear behavior.

6. Claims 13-16, and 19-21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al. 20021015496 in view of Katsuragawa et al. JP-07-114048(English translation provided) ,Hwang et al. 2004/0161575, J. Tominaga, T. Nakano or N. Atoda: Applied Physics Letters. 73 (1998)2078.

Hsu et al. teaches a super-resolution recordable optical disk, as shown in Figs. 6A and B, formed on a substrate 1 made from polycarbonate substrate. On the substrate 1, a reflective layer 3 made of Au, Ag, Al, Cu or their alloys is formed to a thickness of between 70-160 nm. An organic dye layer 22 is formed by spin coating on the metal reflective layer. An interface layer 53 is formed from SiNx, SiO2, or ZnS-SiO2 is formed on the dye-recording layer. **Then a mask layer 52 made from Antimony, silver oxide, or thermochromic organic compounds was formed on the interference layer.** Finally, a dielectric layer 51 and a thin polycarbonate layer 42 is formed on the surface of the mask layer (0026-0027).

Hsu et al. does not teach a mask layer comprising nanoparticles embedded in a non-linear optical material.

Hwang et al. discloses that a silver oxide film is dissociated into silver particles and oxygen upon recording(0012, 0029). Silver oxide has been used as a mask layer in super-RENS optical discs (0011).

Tominaga et al. discloses that an Sb film is a non-linear optical film(abstract). In the reference Sb is used as the material of a mask layer. The antimony film is sputtered and therefore is a layer entirely of Sb particles of various sizes, the other particles forming the matrix.

Katsurgawa et al. teaches a non-linear Aluminum oxide film having Fe, Co, or Ni hyperfine particles embedded therein (0005). The result of adding these hyperfine particles is a film having increased non-linear susceptibility $X^{(3)}$(0005). Also note that this replaces the media of the type described by Iida et al. at [0002].

It would have been obvious to one of ordinary skill in the art to modify the mask layer taught by Hsu et al. by using the masking layers of either Katsuragawa et al. JP-07-114048(English translation provided) ,Hwang et al. 2004/0161575, J. Tominaga, T. Nakano or N. Atoda: Applied Physics Letters. 73 (1998)2078 with a reasonable expectation of forming a useful optical recording medium with a masking layer.

7. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 as applied above and further in view of Fujii et al., "A near-field recording and readout technology using a metallic probe in an optical disk" Japanese Journal of Applied Physics Vol. 39 (2000) pp.980-981.

The combination of Hwang et al. 2004/0161575 in view of Nomura et al. 2002-133720 does not teach an optical disk comprising a data layer, mask layer overlying the data layer and comprising a nonlinear optical material and nanoparticles embedded in the nonlinear optical material where in the data layer comprises Ge2Sb2Te5.

Fujii et al. teaches an optical disk having the structure shown in figure one where the data layer is a Ge2Sb2Te5 phase-change layer and the mask layer is made of

AgOx, a material conventionally used in the prior art.

It would have been obvious to one of ordinary skill in the art to modify the optical recording medium rendered obvious by the combination of Hwang et al. 2004/0161575 in view of Nomura et al. 2002-133720) by using a Ge2Sb2Te5 phase-change layer as the data layer based on the use of a Ge2Sb2Te5 phase-change layer with the AgOx mask layer, a material conventionally used in the prior art, with the reasonable expectation of forming a useful optical recording medium.

2. Claims 13, 19-20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Iida EP 0 580 346 in view of Kester et al. US 5,266,365 and Woudenberg et al. 5,872,882. .

Iida teaches a high density optical disk 2, shown in figure 3, consisting of a substrate 13, a shutter layer 17 formed on the substrate, and a recording film 18 formed on the shutter layer. Recording pits are formed on the recording layer by shining light through the substrate and the shutter layer and onto the recording layer. The shutter layer 17 tightens the irradiated beam for information reproduction or recording allowing for a high-density medium. The shutter layer comprises semiconductor fine particles in a glass or resin matrix. The particle size of the semiconductor fine particles is from 0.1 to 50 nm and preferably from 0.5 to 30 nm(nanoparticles). Therefore the semiconductor fine particles are nanoparticles. **Resins such as polymethyl methacrylates, poly carbonates, polystyrenes, amorphous polyolefins, and epoxy resins can be**

used(claim 22). The particle density affects the properties of the shutter layer and should be at least 1 mol% and should not exceed 80 mol %(3/11-41). The recording layer may be a thin film of an organic dyes such as cyanine or phthalocyanine(claim 19). Function of the shutter layer is disclosed at (4/14-26). The wavelength of the light beam for information reading or writing in the optical disk 310 to 890 nm and the composition of the shutter layer is chosen in accordance with the wavelength actually employed.

The bolded portion shows that the shutter layer comprises metal particles embedded in a glass or resin matrix. Resins include polymethyl methacrylates, polycarbonates, polystyrenes, amorphous polyolefins, and epoxy resins.

Woudenberg teaches non-linear optically active (NLO) polycarbonates and the use of these polycarbonates in waveguides(abstract). The NLO polycarbonate is disclosed at (2/15-67).

Kester et al. teaches epoxy polymeric non-linear optical materials having enhanced stability and good NLO properties(abstract). Description of these NLO epoxy polymeric materials can be found at (3/29-4/3).

It would have been obvious to one of ordinary skill in the art to modify the shutter layer comprising nano-particles embedded in a resin matrix taught by Iida et al by using the non-linear epoxy polymeric materials taught by Kester et al. or the non-linear polycarbonates taught by Woudenberg as the material of the resin matrix based on the disclosure in Iida to use epoxy resins or polycarbonate resins and with the reasonable expectation of success. Further, one would expect that by using a non-linear material as

the matrix material that the non-linear susceptibility of the resulting film would be increased..

8. Claims 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 as applied above in view of Sonnichsen et al. "Drastic Reduction of Plasmon Damping in Gold Nanorods" Physical Review Letters. Volume 88, Number 7, 2002.

Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 as applied above does not teach the use of nanoparticles in a mask layer where in nanoparticles comprise rods or shells wherein the rods have widths of about 20 nm and lengths of about 50 nm.

Sonnichsen teaches the scattering of light by gold nanoparticles including gold nanorods having lengths up to 100 nm and diameters of 20-150 nm. Figure 3 shows that scattering by gold nanorods produces a spectrum having a narrower line width than the light scattering spectrum formed by gold nanospheres. Use of nanorods results in high light scattering efficiencies and large local field enhancement factors, making nanorods interesting for a range of optical applications.

In regard to claim 26 the teaching that the nanorods have lengths of less than 100 nm meets the limitations of these claims which recites a nanorod length of 20 to 50

am.

It would have been obvious to one of ordinary skill in the art to modify the super resolution layer, comprising a dielectric material(ZnS or ZnS-SiO_2) with metal particles dispersed therein, of the optical recording medium taught rendered obvious by the combination of Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 by using rod or sphere shaped nanoparticles with the reasonable expectation of forming a mask layer which exhibits high light scattering efficiency and large local field enhancement factors as taught by Sonnichsen et al.

9. Claims 25 and 28-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 as applied above in view of Sonnichsen et al. "Drastic Reduction of Plasmon Damping in Gold Nanorods" Physical Review Letters. Volume 88, Number 7, 2002 as applied above and further in view of Perry et al. WO 02/48432(US 2004/0079195).

Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 as applied above does not teach gold nanoparticles embedded in the mask layer. Further, Nomura et al. does not teach coated nanoparticles where the coating comprises oligonucleotides

functionalized on the 5' or 3' end with alkylthiol.

Perry et al. teaches a film containing metal particles in a matrix. The matrix material may be polymer, glass, highly viscous liquid etc. The metal particles can be silver, gold, copper, or iridium nanoparticles with dimensions of from 1 to 200 nm (diameter) coated with organic ligands (WO pgs. 15-16). Nanoparticles are coated with organic ligands composed of essentially 3 parts A-B-C. A is a molecular or ionic fragment that has at least one atom having a lone pair of electrons that can bond to the metal nanoparticle surface. A can be an alkylthiol group. Part B is an organic fragment that has two points of attachment, one to A and one to C. B can be a single bond. Part C is a molecular fragment with one point of attachment to fragment B. C may be an oligonucleotide strand. The bond is either at the 5' or the 3' end of the oligonucleotide strand(WO pgs 16(bottom)to 17). Perry et al. also teaches that these coatings can stabilize the nanoparticles with respect to aggregation and or coalescence of the metal core of the particle (page 8, 2nd paragraph).

It would have been obvious to one of ordinary skill in the art to modify the super resolution layer, comprising a dielectric material with metal particles dispersed therein, of the optical recording rendered obvious by the combination Hwang et al. 2004/0161575 in view of Nomura et al. JP 2002-133720 by coating the particles with the coating, comprising an oligonucleotide having an alkylthiol group bound to either the 3' or the 5' end, taught by Perry et al. at (WO pgs 16(bottom) to 17) with the reasonable

expectation of forming a film whose metal nanoparticles are stabilized with respect to aggregation and or coalescence of the metal core of the particle(page 8, 2nd paragraph). Further, it would have been obvious to use gold nanoparticles based on the disclosure of Perry et al.

In regard to claim 28 which claims that the nanoparticles embedded in the mask layer comprise vertically aligned nanoparticles, the applicant has the burden of distinguishing their invention from that disclosed in the prior art or establishing the criticality of vertically aligned nanoparticles. The figure on the front of Perry et al.(US2004/0079195) shows vertically aligned nanoparticles.

Conclusion

10. THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ANNA L. VERDERAME whose telephone number is (571)272-6420. The examiner can normally be reached on M-F 8A-4:30P.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Huff can be reached on (571)272-1385. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/A. L. V./
Examiner, Art Unit 1795

/Martin J Angebranndt/
Primary Examiner, Art Unit 1795